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THE HIDDEN WING-PATTERN OF SOME PALEARCTIC SPECIES OF GONEPTERYX AND ITS TAXONOMIC VALUE

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THE WING-PATTERN of the lepidopterous insects is a marvellous phenomena, the biological importance of which is not yet entirely clear. The studies carried out by the late Dr. B. N. Schwanwitsch (1924) gave a starting-point to researches in this field of lepidopterology.

The fact of the existence of different wing-patterns is, of course, partly connected with the visual perceptions of a butterfly, and the biological importance of the pattern is partially mediated by vision. On the one hand, the pattern hides a butterfly from possible carnivorous enemies by its mimetic, or camouflage, similarity with other, "uneatable" insect, or natural objects; on the other hand, such a pattern can act as a visual sign of the species and assure this way, interspecific sexual isolation.

It is widely known that an insect is different from man in that it can see in the ultra-violet part of the sun spectra. This has forced some students to look on the butterflies "with a butterfly's eye." In 1957, G. A. Mazokhin-Porshnyakov studied optical characters of wings in some groups of butterflies and moths in UV-rays and found hidden patterns in some Pierid butterflies which he subjected to quantitative analysis.

This discovery confirms my previous suggestions on the biological value of the wing-pattern and of its significance as a taxonomic character.

The main task of this paper is to illustrate some examples of the usage of hidden patterns for taxonomic purposes.

MATERIAL AND METHOD

The method has been worked out by G. A. Mazokhin-Porshnyakov (1957). It consists in taking pictures on unsensibilized (positive or color-blind) film when the lens of a camera is covered with black-glass filter transparent for the ultra-violet rays ($\lambda = 365\ m\mu$).

I used a 35 mm mirror camera Zenit-3 with a lens Industar-50. As a source of light, the mercury vapor lamp PRK-4 has been used.

Specimens of *Gonepteryx rhamni L., G. cleopatra L.* and *G. mahaguru* (*niphonica* Vty.) served as materials for this work.

DESCRIPTION OF PATTERNS AND TERMINOLOGY

This paper deals with male hidden patterns only, because of the irregular nature of it in females. As a rule, the female's wing pattern shows that her wing absorbs ultra-violet rays over the entire wing surface. That is why all females are dark on pictures and why they are very much like the lower wing surface of a male. Perhaps, future students of this phenomenon ought to draw attention to this "half character" of hidden patterns.

Common to all three species is the presence in the upper surface of the forewing of a marginal dark zone (*zona opaca marginalis*), which broadness is maximal in *rhamni* and minimal in *cleopatra*. It is notable that in the costal-anal direction in all species, a narrow dark line appears for about half of the wing length (*linea opaca medialis*) (fig. 1).

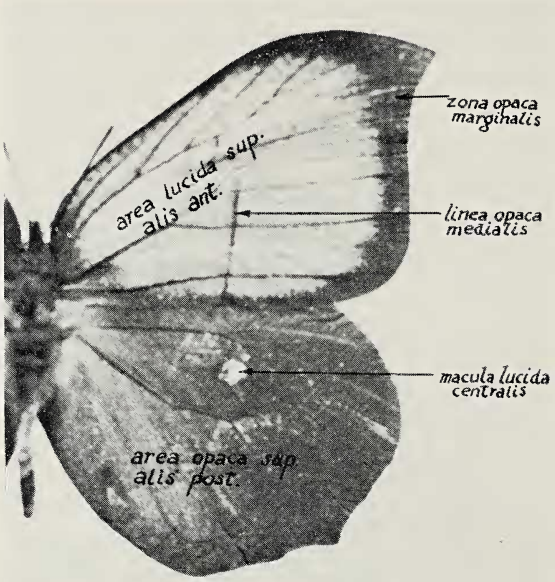
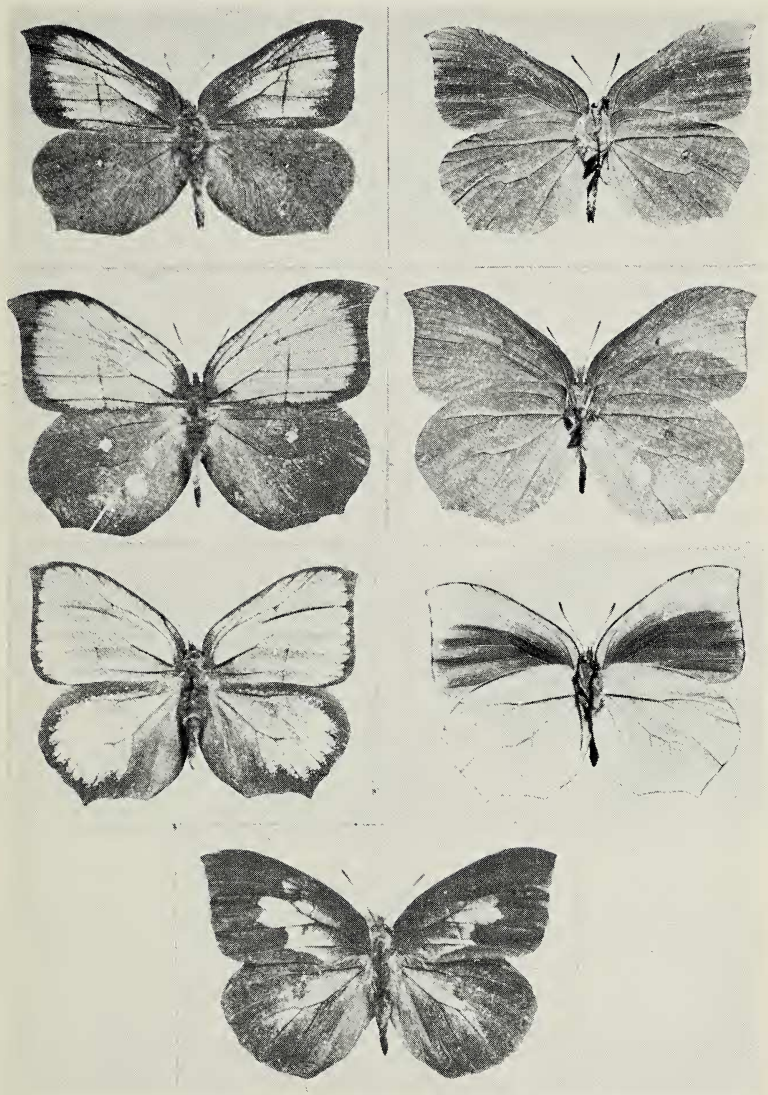


Fig. 1. Terminology of the hidden wing-pattern as illustrated by an example of *G. mahaguru niphonica* Vty - photographed with U. V. light.



Specimens of Gonepteryx photographed with U. V. light; upper side, right; lower side, left.
Fig. 2. *G. rhamni*
Fig. 3. *G. mahaguru niphonica* Vty.
Fig. 4. *G. cleopatra* L.
Fig. 5. *Zerene eurydice* Bdv. upper side only.

The upper surface of the hindwing absorbs ultra-violet far more than the forewing does. In *G. rhamni* and *mahaguru,* the entire surface is dark with the exception of a small central spot *(macula lucida centralis).* In *G. cleopatra,* this spot becomes very large and occupies nearly all the surface with the exception of a dark marginal zone that is similar to such a zone in the forewing.

KEY FOR THE IDENTIFICATION OF GONEPTERYX SPECIES

Upper surface of the male wing.

1(2) Dark marginal zone on the forewing broad, occupies more than ¼ of the whole wing-surface. Just a small bright spot on the hindwing ..... *rhamni* L. (fig. 2)

2(1) Bright spot on the hindwing larger.

3(4) Dark marginal zone on forewing narrower than in *rhamni,* bright spot on the hindwing .....*mahaguru niphonica* Vty. (fig. 3)

4(3) Dark marginal zone on the forewing very narrow; bright field on the central part of the hindwing .....*cleopatra L.* (fig. 4)

DISCUSSION

In my study of the wing-pattern of the *Pieridae,* I have presumed (1964) that it consists of a number of successively-deposited coloured layers which are fully presented and occupy the whole wing surface in the prototype, but which are presented in fragments only in actual specimens. It was a formal theory I made for the sake of having a point to work from in explorations. Then I draw my attention to the fact that fields of the wing which are black in visible light are also dark in the ultra-violet [*Zerene* (fig. 5) *Catopsilia* and other relatives of *Gonepteryx*]. Perhaps in these species in which the black elements of the pattern are absent in visible light but are present in the ultra-violet, we deal with reduced black patterns. The main problem is then to recognize the direction of evolutionary changes in this group.

ACKNOWLEDGMENT

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REFERENCES

MAZOKHIN-PORSHNYAKOV, G. A., 1957. The reflecting qualities of the wings of butterflies and the role of ultraviolet rays in visual perceptions of insects. *Biofizika* 2(3): 358-368 (In Russian; English summary).

NEKRUTENKO, Y. P., 1964. On the method of quantitative analysis of the wing-pattern of *Pieridae* (*Lepidoptera*). *Dopovidi Acad. Sci. Ukrainian S.S.R.,* 3: 405-407. (In Ukrainian; Russian & English summaries).

SCHWANWITSCH, B. N., 1924. On the ground plan of wing-pattern in Nymphalids and certain other families. *Proc. Zool. Soc. Lond.,* part 2: 509-528.